Ramification of Frequent Earthquakes on Landuse Pattern in And Around Patan Tehsil in Satara District of Maharashtra.

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Abstract
        Earthquakes has its major impact on human activities. Land use depends on human activities. Percentage of land use and human activities changes with distance from epicenters. Earthquake effects on economic activities of people in seismic area. The current research paper is a Study of Impacts of Earthquake on Land use in and around Patan Tehsil in Satara District of Maharashtra. Most of the primary data regarding impact of earthquakes is being collected through field work. E.g. Field visits, Surveying and Interviews to villagers and secondary data collected through the Seismological Dept. Koyna dam. The Chi-Square test is used to check the association between two categorical variables. There is association between earthquake risk zone and Economic development or both factors are dependent. As the distance increases from the earthquake risk zone, the impact on Economical relation lowered.
Key Words: Land use, Earthquake, risk zone, Economic activities.

Introduction:
        Earthquakes have short term impacts as well as long term impacts. Land use depends on human activities. Percentage of land use and human activities changes with distance from epicenters increases. Earthquake effects on economic activities of people in seismic area. The current research paper is a Study of Impacts of Earthquake on Land use in and around Patan Tehsil in Satara District of Maharashtra.
        Earthquake is an instant activity which causes Loss of human, domestic animal, and plant life, loss of property, Earthquakes can destroy settlements, loss of clean water, and loss of contiguous land mass, deforestation and had a considerable effect on that nation's and local economy, Aftershocks can cause even more damage to an area. Earthquakes have short term impacts as well as long term impacts. The short term impacts can be seen in the aftermath of earthquakes. A powerful earthquake can destroy buildings, factories, shops, roads, bridges and schools. Secondary effects occur as a result of the primary effects, e.g. tsunamis or fires due to ruptured gas mains. Long-term impacts cause many people to become homeless. Furthermore, earthquakes can cause disruption to public services in the area.

Objectives:
The present study is based on the following objectives:
·   To study the geographical setup of the study area.
·   To study the effects of frequent earthquakes on land use in the study area.

Study Area:
        The area of study includes five Tehsils, i.e. Patan (Satara), Shirala (Sangli), Shahuwadi (Kolhapur), Chiplun and Sangmeshwer (Ratnagiri) districts in the state of Maharashtra. The study area is earthquake prone region. The study area is located between 16°43' North Latitude to 17°53' North Latitude and 73°19' East Longitude to 74°13'East Longitude Respectively.

Figure No. 1. Location Map of Study area.

Total geographical area of study area is 6416.68 sq. km. in Maharashtra. Patan Tehsil and surrounding region is the constructing part of the Western Ghats. The study area experienced continuous seismicity for last 50 years. The study area comes under IVth zone of earthquake in India. The study area is tremor by V to VIII Intensity of frequent earthquake.

The Study area has Mountain landscapes and Average high temperature 28.8°C, Average low temperature 13.7 °C, Mean temperature range is 24°C. Rainfall in this region averages 3000–4000 mm (120–160 inches). About 200 inches of rainfall with Koyna and Chandoli reserved forest. The distribution of human population is low. In deficiency of facilities delivered to the people, they are behind in respect of progress in the present world. Almost all population resides in rural areas except i.e. Chiplun, Malkapur, Devrukh city. The high literacy rate is above 70.72 percent recorded at all Tehsils. The most of the Study area is covered by irrigated and non-irrigated farming and the common product is sugarcane and rice crop. The settlements are small in scattered form. Majority of the rural settlements are small up to the size of hamlet. Transport system still has not been developed due to the seismic and hilly character of Study area.

Database & Methodology:

Maximum primary data about impact of earthquakes on society is being collected through field work. E.g. Field visits, Surveying and Dialogues with local and officials. The secondary data is

being collected through related reference books, magazines, published unpublished Articles, journals, and published Govt. Report, District Census hand book, Newspapers, Other media reports and relegated websites. The collected facts are analyzed with The Chi-Square test. It is used to check the association among two definite variables.

Where, Oi and Ei are studied and probable frequency respectively. 2 follows chi-square dispersal with (r-1) (c-1) degree of freedoms, where r and c are number of rows and columns respectively. We reject the null hypothesis H0 at α% level of significance if p-value less than equal to. The p-value is a smallest level of significance at which we discard H0.

The map tables are applied for presenting, and for interpretation which is supportive for getting suitable inferences.

Repercussion of Earthquake on Landuse Pattern:

It is observed that continuous earthquake effects the land use in the study area. Land use pattern changes according earthquake risk zone. There are various aspects of land use which is changes when distance from epicenters increases. Land use depends on human activities. Human activities also effected by seismic events in area. Percentage of land use and human activities changes with distance from epicenters increases. The total land under very high risk zone is 130642.02 hectors. 164972.5 hectors in high risk, 131341.8 hectors in moderate risk and 103934.7 hectors in low risk zone.

Table No. 1.1 Land Use in Earthquake Risk Zone of study area.

Land use Area (in Hectares)	Earthquake Risk Zone area (in percent)				
	Very High	**High**	**Moderate**	**Low**	**Total**
Forest Area	11.54	5.31	6.11	10.29	33.25
Area under Non-Agricultural Uses	5.96	5.09	4.93	3.41	19.39
Barren & Uneultivable Land Area	7.53	7.42	7.78	2.98	25.7
Permanent Pastures and Other Grazing Land Area	0.92	1.70	1.88	0.97	5.46
Land Under Miscellaneous Tree Crops etc.	3.03	3.83	2.91	0.88	10.65
Cultivable Waste Land Area	11.76	11.29	7.86	5.08	35.99
Fallows Land other than Current	3.42	3.53	2.88	1.94	11.77
Current Fallows Area	6.86	4.22	3.07	0.97	15.12
Net Area Sown	24.48	28.80	31.65	36.74	121.67
Total Unirrigated Land Area	23.31	27.41	28.64	31.91	111.26
Area Irrigated by Source	1.17	1.37	3	4.8	10.39

(Source: Calculated by Researcher)

There are overall 60916.35 hector land is covered with forest in study area. The forest area in very high risk zone is 199662.49 hectors land which is 11.54 percent of total area. It is highest among all risk zone because of high risk of earthquake there are minimum human activities and settlement. As the distance increases from epicenters forest area decreases. It is 5.31 percent, 12314.12 hector land in high risk zone, 6.11 percent 11737.98 hector land in moderate risk zone and low risk zone 16901.76 hector land that is10.29 percent area of this risk zone. The increase in forest area in low risk zone because the most of the area came in the Shahuwadi and Sangmeshwer Tehsil. These Tehsils have large forest area.

The total Land under Miscellaneous Tree Crops in study area is 21147.01 hector. There is 3.03 percent (5240.64 hectare) area in very high risk zone. 3.83 percent (8878 hectare) area in high risk zone. 2.91 percent (5583.24 hectare) area in moderate risk zone and 0.88 percent (1445.13 hectare) in low risk zone. The area under Miscellaneous Tree Crops in study area is gradually decreases from very high risk to low risk zone.

The study area has total 50083.83 hectare of land under Barren & Un-cultivable Land Area. From this total land very high risk zone contain (26.02 percent) 13033.09 hectors, (26.02 percent) 17199.23 hectors in high risk zone, (26.02 percent) 14948 Hectors in moderate risk zone and (26.02 percent) 4903.01 hectors land in low risk zone. Risk zone wise percentage of land under Barren & Un-cultivable Land Area26.02, 34.340, 29.846 and 9.78 percent area is under land under Barren & Un-cultivable Land from very high risk zone to low risk zone. Progressively decreasing with distance from epicenters and earthquake risk zone because of there is growth of human agricultural activities with earthquake risk from high to low.

FIGURE NO. 7.3

Figure 1.1

Total area under Permanent Pastures and Other Grazing Land in study area is (1.21 percent) 10733.38 hectors. Out of this (2.38 percent) 1593.05 hectare of land carried by Very High Risk Zone, 3929.96 hectare Land kept by High Risk Zone, (2.74 percent) 3611.59 hectare land in Moderate Risk Zone and (1.53 percent) 1598.78 hectare land hold by Low Risk Zone. The Permanent Pastures and Other Grazing Land is low in very high risk zone and progressively increase with earthquake risk decreases.

Entire Cultural Waste Land Area in study area is 69955.77hectare land. The percentage of cultivable Waste Land Area in very high risk zone is 15.56 percent, high risk zone is 15.86 percent, and moderate risk zone is 11.50 percent and 8.02 percent in low risk zone. The area under very high risk zone is 20339.6 hectare land. In high risk zone 26166.97 hectare. In moderate risk zone 15110.06 hectares and in low risk zone it contains 8339.11 hectare area. It is observed that the area of Cultural Waste Land is gradually decreases from high risk area to low risk area. This is because of growth of human activities in low risk area as compare to high risk zone.

In the same way area of Fallows Land other than Current Fallows land is also decreases with earth risk decreases with lowered risk zone. There is total 22805.13 Hectares area is under Fallows Land in study area. It is 5907.93 Hectares area in Very High Risk Zone with 4.52 percent of the zone. Than 8185.86 Hectares area in High Risk Zone with 4.96 percent of that zone and 5528.72Hectare with 4.2 percent and 3182.62 Hectares 3.06 percent Land are in Moderate Risk and Low Risk Zone respectively.

The effect of earthquake on Current Fallows Land is clearly observed. That is as earthquake risk decreases the area under Current Fallows Land also decreases. It is because of fearless growth of human activities as risk lowered. There is 29154.43 Hectares Land in whole study area. Out of this 11894.51 Hectares Land (9.1percent) in Very High Risk Zone. 9775.39 Hectares Land (5.9 percent) in High Risk Zone. 5890.68 Hectares Land (4.4 percent) in Moderate Risk Zone and in Low Risk Zone there is 1593.85 Hectares Land (1.5 percent) in respected risk Zone.

Entire Area under Non-Agricultural Uses in study area is 35814.17hectares. The percentage of Area under Non-Agricultural Uses in very high risk zone is 7.89 percent, high risk zone is 7.14 percent, and moderate risk zone is 7.79 percent and 5.387 percent in low risk zone. The area under very high risk zone is 10316.71 hectare land. In high risk zone 11791.54 hectare. In moderate risk zone 8106.54 hectares and in low risk zone it contains 5599.38 hectare area. It is observed that the area of Cultural Waste Land is gradually decreases from high risk area to low risk area. This is because of growth of human activities in low risk area as compare to high risk zone.

The effect of earthquake on Net Area Sown Land is clearly observed. That is as earthquake risk decreases the area under Net Area Sown Land is increases. It is because of fearless growth of agricultural activities as earthquake risk lowered. There is 230281.3 Hectares Land in total study area. Out of this 42354.19 Hectares Land (32.4 percent) in Very High Risk Zone. 66731.46 Hectares Land (40.4 percent) in High Risk Zone. 60824.53 Hectares Land (46.3 percent) in Moderate Risk Zone and in Low Risk Zone there is 60371.08 Hectares Land (58.08 percent) in respected risk Zone

Conclusion:

It is observed that continuous earthquake effects the land use in the study area. Land use pattern changes according earthquake risk zone. While analyzing Economic activities in study area Fisher's exact test Value is 0.049. Here, p-value<0.05 and it indicate that accept null hypothesis H0 at 5percent level of significance. That is, there is an association between risk zone and occupation or both factors are independent.

There are various aspects of land use which is changes when distance from epicenters increases. Percentage of land use and human activities changes with distance from epicenters

increases. The percentage of Area under Non-Agricultural Uses is decreases with very high risk zone to low risk zone and Percentage of land under Net Area Sown increases with reduced the earthquake risk in study area.

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